# Canadian Journal of Civil Engineering

# Revue canadienne de génie civil

**Volume 20, 1993**


## Contents / Sommaire

### February / Février

ARTICLES


**Athanasios Loukas and Michael C. Quick** Hydrologic behaviour of a mountainous watershed 1

**R.L. Droste and J.C. Johnston** Urban snow dump quality and pollutant reduction in snowmelt by sedimentation 9

**B.C. Anderson and D.S. Mavinic** Behaviour of volatile and nonvolatile suspended solids in the pilot-scale aerobic digestion of waste-activated sludges 22

**K.N. Helali and A.M. Khan** Regression-based urban arterial road delay models 37

**Sujeeva A. Weerasuriya and Poojitha D. Yapa** Unidirectional spreading of oil under solid ice 50

**R.D. Tyagi, J.F. Blais, N. Meunier, et D. Kluepfel** Biolixiviation des métaux lourds et stabilisation des boues d'épuration : essai en bioréacteur opéré en mode cuvée 57

**Osama Moselhi** Schedule compression using the direct stiffness method 65

**A.C. Heidebrecht and A. Rutenberg** Evaluation of foundation tie requirements in seismic design 73

**Dale I. Bray and Huixi Xie** A regression method for estimating suspended sediment yields for ungauged watersheds in Atlantic Canada 82

**S. Beltaos** Numerical computation of river ice jams 88

**K.W. Biggar, D.C. Sego, and M.M. Noël** Laboratory and field performance of high alumina cement-based grout for piling in permafrost 100

**S.F. Ng, M.S. Cheung, and H.M. Hachem** Study of a curved continuous composite box girder bridge 107

**U.G.A. Puswewala and R.K.N.D. Rajapakse** Computational analysis of creep in ice and frozen soil based on Fish's unified model 120

**David Hansen and Dale I. Bray** Single-station estimates of suspended sediment loads using sediment rating curves 133

**Gary R. Smith and Awad S. Hanna** Factors influencing formwork productivity 144

**Paulette B. Hanna, Awad S. Hanna, and Thomas A. Papagiannakis** Knowledge-based advisory system for flexible pavement routine maintenance 154


DISCUSSIONS


**Ron Kent** Disposal of hazardous wastes in Canada's Northwest Territories: Discussion 164

**P.L. Heeney and G.W. Heinke** Disposal of hazardous wastes in Canada's Northwest Territories: Reply 164

**L.D. Baikie** Soil-steel structure design by the third edition of OHBDC: Discussion 165

**George Abdel-Sayed, Baidar Bakht, and Ernest T. Selig** Soil-steel structure design by the third edition of OHBDC: Reply 166


BOOK REVIEW / CRITIQUE DE LIVRE


**Pierre Quenneville** Structural behaviour of timber 168

**Editorial policy / Orientation de la revue** iii

**Instructions to authors** v

**Recommandations aux auteurs** vii


### April / Avril

ARTICLES


**Mukesh Sharma, W.B. Hall, and E.A. McBean** Reliability analyses of activated sludge systems in attaining effluent standards 171

**Osama Moselhi and Pasit Lorterapong** Least impact algorithm for resource allocation 180

**Michael Isaacson, Norman Allyn, and Gary Loverich** Development of a net pen system for aquaculture farming 189

**Eugene J. O'Brien and Robert E. Loov** A method for the derivation of load effect envelopes based on statistical considerations 201

**G.K. Luk and H.F. Kuan** Modelling the behaviour of oil spills in natural waters 210

**M. Jimi Arey and Brian W. Baetz** Simulation modelling for the sizing of solid waste receiving facilities 220

**Yean-Jye Lu and Xidong Yuan** Color image analysis for vehicle speed measurement 228

**Alan D. Russell and Ibrahim Al-Hammad** A knowledge-based framework for construction methods selection 236

**A.H.P. Maurenbrecher and G.T. Suter** Frost damage to clay brick in a loadbearing masonry building 247

**O. Chaallal and B. Benmokrane** Physical and mechanical performance of an innovative glass-fiber-reinforced plastic rod for concrete and grouted anchorages 254

**D.I. Nwosu, A.S.J. Swamidas, and K. Munaswamy** Numerical stress analysis for fatigue evaluation of welded tubular T-joints 269

**J.L. Humar and A.M. Kashif** Dynamic response of bridges under travelling loads 287

**M.E. Neis and V.V. Neis** An interactive program for the limit states design of wood 299

**Murat Saatcioglu and Michel Bruneau** Performance of structures during the 1992 Erzincan earthquake 305

DISCUSSIONS

**S. Beltaos** Bend ice jams: laboratory observations: Discussion 326

**R. Ettema and G.E. Urroz** Bend ice jams: laboratory observations: Reply 328

**Ralph D. Watts** A proposed dynamic foundation factor for the National Building Code of Canada: Discussion 328

**Kamel Elhmadi and Arthur C. Heidebrecht** A proposed dynamic foundation factor for the National Building Code of Canada: Reply 329

**Cedric Marsh** Factored axial compressive resistance of schifflerized angles: Discussion 330

**Seshu Madhava Rao Adluri and Murty K.S. Madugula** Factored axial compressive resistance of schifflerized angles: Reply 330

**Franz Knoll** Seismic performance of reinforced concrete ductile moment-resisting frame buildings located in different seismic regions: Discussion 333

**T.J. Zhu, W.K. Tso, and A.C. Heidebrecht** Seismic performance of reinforced concrete ductile moment-resisting frame buildings located in different seismic regions: Reply 334

**R. Tremblay, S.F. Stiemer, and A. Filiatrault** Overview of seismic provision changes in National Building Code of Canada 1990: Discussion 334

**W.K. Tso** Overview of seismic provision changes in National Building Code of Canada 1990: Reply 339

BOOK REVIEWS / CRITIQUES DE LIVRES

**D. Feldman** Fibre reinforced cementitious composites 341

**D. Feldman** Repair and protection of concrete structures 342

## JUNE / JUIN

ARTICLES

**Larry McNally** Engineers and waterpower on the Lachine Canal, 1843–1871 343

**Ricardo O. Foschi, Bryan Folz, and Felix Yao** Reliability-based design of wood structures: background to CSA-O86.1-M89 349

**Felix Z. Yao and Ricardo O. Foschi** Duration of load in wood: Canadian results and implementation in reliability-based design 358

**H. Mohamed El Hussein and A.O. Abd El Halim** Differential thermal expansion and contraction: a mechanistic approach to adhesion in asphalt concrete 366

**N. Rajaratnam, G.A. Johnston, and M.A. Barber** Energy dissipation by jet diffusion in stormwater drop shafts 374

**Edward S.K. Fekpe, Alan M. Clayton, and Attahiru Sule Alfa** Aspects of performance of truck weigh stations 380

**Michael Isaacson, Enda O'Sullivan, and John Baldwin** Reflection effects on wave field within a harbour 386

**Aftab A. Mufti, Leslie G. Jaeger, Baidar Bakht, and Leon D. Wegner** Experimental investigation of fibre-reinforced concrete deck slabs without internal steel reinforcement 398

**Gerard R. Monforton, Murray C. Temple, and Gerhard W.H. Wolf** An experimental and theoretical evaluation of a floor truss system 407

**Hubert Chanson** Stepped spillway flows and air entrainment 422

**Dale M. Nesbitt, Gordon A. Sparks, and Russell D. Neudorf** A semi-Markov formulation of the pavement maintenance optimization problem 436

**Chris Zeiss** Hazardous material loading to municipal landfills in resource-based communities 448

**Simaan M. AbouRizk and Anil Sawhney** Subjective and interactive duration estimation 457

**M. Nazrul Islam and Prianka N. Seneviratne** Work-zone traffic management with transportation planning software 471

**Saad Bennis et Pierre Bruneau** Comparaison de méthodes d'estimation des débits journaliers 480

**Saad Bennis et Pierre Bruneau** Amélioration de méthodes d'estimation des débits journaliers 490

**J. Gagnon, J.B. Sérodes, et G. Simian** SEXTANG : système expert d'aide à l'exploitation des stations d'épuration par étangs aérés facultatifs 500

**D. Couillard et M. Chartier** Influence des caractéristiques des boues digérées en aérobiose sur la solubilisation biologique des métaux 509

**Patrick Polan, Jean Gagnon, et J. Peter Jones** L'utilisation du compost de boues de stations d'épuration des eaux comme substrat de culture pour la production des plants forestiers en récipients 518

**H. Roger Woodhead** Hibernia development project — development of the construction site 528

NOTE

**Willi H. Hager** Classical hydraulic jump: free surface profile 536

DISCUSSIONS

**Ralph D. Watts** Seismic response of concentrically braced steel frames: Discussion 540

**Richard G. Redwood, Feng Lu, Gilles Bouchard, and Patrick Paultre** Seismic response of concentrically braced steel frames: Reply 541

AUGUST / AOÛT

ARTICLES

**Carol Boyle and Brian Baetz** Household hazardous wastes: options for management 543

**D.H. Willis, M.H. Davies, and G.R. Mogridge** Laboratory observations of bedforms under directional irregular waves 550

**R.O. Foschi and F.Z. Yao** Reliability analysis of wood I-joists 564

**Robert W. Clinch** Structural characteristics of wood composite I-beams 574

**C.D. Smith** Selection of design flood frequencies for hydraulic structures 582

**Pierre Léger and Patrick Paultre** Microcomputer analysis of reinforced concrete slab systems 587

**Andrew N. Blair, Leonard M. Lye, and W.J. Campbell** Forecasting construction cost escalation 602

**Nesa Ilich** Improvement of the return flow allocation in the Water Resources Management Model of Alberta Environment 613

**Erol Karacabeyli, Conroy Lum, and Link Olson** Strength and stiffness of glulam trusses with punched metal plated joints 622

**J.L. Dawe and S.J. Guravich** Branch plate to reinforced HSS connections in tension and compression 631

**Telvin Rezansoff, James A. Zacaruk, and Jeffrey G. Afseth** High cycle (fatigue) resistance of reinforced concrete beams with lap splices 642

**M. Sonebi et K.H. Khayat** Bétons à haute performance pour fabriquer des panneaux destinés à réparer des structures submergées 650

**Maher A. Nessim, Han Ping Hong, and James G. MacGregor** Verification of the material resistance factors in the CSA-S474 code for offshore concrete structures 660

**A.K. Jain, R.G. Redwood, and Feng Lu** Seismic response of concentrically braced dual steel frames 672

**K.S. McKay and M.A. Erki** Flexural behaviour of concrete beams pretensioned with aramid fibre reinforced plastic tendons 688

**H. Marzouk and Z.W. Chen** Nonlinear analysis of normal- and high-strength concrete slabs 696

NOTES

**Murray C. Temple and Ghada Elmahdy** Equivalent slenderness ratio for built-up members 708

**Yue Qing Lu and D.J. Laurie Kennedy** Correction of residual strain for coupons that curve on sectioning 712

DISCUSSIONS

**J.F. Bonacci** Confinement limits for tension lap splices under static loading: Discussion 715

**T. Rezansoff, U.S. Konkankar, and Y.C. Fu** Confinement limits for tension lap splices under static loading: Reply 716

**Colin H. Campbell** Thin unreinforced concrete house foundation walls: Discussion 717

**William Hanuschak** Thin unreinforced concrete house foundation walls: Discussion 717

**P. Dozzi, J. Warwaruk, and B. Laviolette** Thin unreinforced concrete house foundation walls: Reply 718

**Daniel W. Halpin** Subjective and interactive duration estimation: Discussion 719

**Simaan M. AbouRizk and Anil Sawhney** Subjective and interactive duration estimation: Reply 720

BOOK REVIEW / CRITIQUE DE LIVRE

**Marie-Anne Erki** Microstructural design of fiber composites 722

OCTOBER / OCTOBRE

ARTICLES

**J.A. Nicell, J.K. Bewtra, N. Biswas, C.C. St. Pierre, and K.E. Taylor** Enzyme catalyzed polymerization and precipitation of aromatic compounds from aqueous solution 725

**John B. Collins** An innovative lamp-post design of 1916 — a fine example of urban heritage in Ottawa 736

**F.J. Vecchio, N. Agostino, and B. Angelakos** Reinforced concrete slabs subjected to thermal loads 741

**S.F. Ng, M.S. Cheung, and J.Q. Zhao** A materially nonlinear finite element model for the analysis of curved reinforced concrete box-girder bridges 754

**Leonard M. Lye** A technique for selecting the Box–Cox transformation in flood frequency analysis 760

**P. Lessard, D. Martel, et B. Desjardins** Modélisation du comportement des matières en suspension à l'effluent d'un décanteur primaire lamellaire 767

**Yousef A. Al-Salloum and Ghulam Husain Siddiqi** Optimum design of frames under alternate loading condition 778

**Simon J.T. Pollard, Robert E. Hoffmann, and Steve E. Hrudey** Screening of risk management options for abandoned wood-preserving plant sites in Alberta, Canada 787

**Yin Chen and A.S.J. Swamidas** Change of modal parameters due to crack growth in a tripod tower platform 801

**D. Prasad, J.G. Henry, and A. King** Coliform inactivation in sludge by copper sulphate 814

**J.A. Kells** Spatially varied flow over rockfill embankments 820

**A. Picard and D. Beaulieu** Factored moment resistance of composite bridge girders with singly symmetric non-compact steel sections 828

**Osama Moselhi and Khaled El-Rayes** Least cost scheduling for repetitive projects 834

**J. Wright, Z. Shen, and S. Rizkalla** A three-year field and laboratory evaluation of linseed oil as a concrete sealer 844

**M.S. Cheung, S.F. Ng, and J.Q. Zhao** Analysis of curved reinforced concrete slab bridges by the spline finite strip method 855

**Pierre Quenneville, Alain Charron, and Karl Van Dalen** Effect of end distance on the resistance of split ring connectors in timber joints loaded in compression 863

NOTE

**T.D. Prowse** Suspended sediment concentration during river ice breakup 872

DISCUSSIONS

**Mark F. Green** Bridge dynamics and dynamic amplification factors — a review of analytical and experimental findings: Discussion 876

**Patrick Paultre, Omar Chaallal, and Jean Proulx** Bridge dynamics and dynamic amplification factors — a review of analytical and experimental findings: Reply 878

**Sabah Alkass** A knowledge-based framework for construction methods selection: Discussion 879

**Alan D. Russell and Ibrahim Al-Hammad** A knowledge-based framework for construction methods selection: Reply 881

**David B. Beal** Experimental investigation of fibre-reinforced concrete deck slabs without internal steel reinforcement: Discussion 882

**Aftab A. Mufti, Leslie G. Jaeger, Baidar Bakht, and Leon D. Wegner** Experimental investigation of fibre-reinforced concrete deck slabs without internal steel reinforcement: Reply 883

BOOK REVIEW / CRITIQUE DE LIVRE

**R.A. McKim** Computerized management of multiple small projects 884

## December / Décembre

ARTICLES

**Ian Smith, Lin J. Hu, and Allison B. Schriver** Free flexural vibration analysis of one-way stiffened plates by the free interface modal synthesis method 885

**Murray C. Temple and Ghada Elmahdy** Buckling of built-up compression members in the plane of the connectors 895

**Poojitha D. Yapa and David P. Belaskas** Radial spreading of oil under and over broken ice: an experimental study 910

**M. Azhari and M.A. Bradford** Elastic local buckling of composite tee-beams with longitudinal stiffeners 923

**J.L. Dawe and T.S. Lee** Local buckling of Class 2 beam-column flanges 931

**M.O. Al-Hunaidi** Insights on the SASW nondestructive testing method 940

**P. Léger, A.K. Tayebi, and P. Paultre** Spectrum-compatible accelerograms for inelastic seismic analysis of short-period structures located in eastern Canada 951

**J.L. Dawe and G.G. Aridru** Prestressed concrete masonry walls subjected to uniform out-of-plane loading 969

**Leslie G. Jaeger and Baidar Bakht** Reliability of concrete strength prediction from limited test data 980

**Patrick Paultre, Guy Lefebvre, Jean-Philippe Devic, and Gaétan Côté** Statistical analyses of damages to buildings in the 1988 Saguenay earthquake 988

**P. Léger, J. Venturelli, and S.S. Bhattacharjee** Seasonal temperature and stress distributions in concrete gravity dams. Part 1: modelling 999

**P. Léger, J. Venturelli, and S.S. Bhattacharjee** Seasonal temperature and stress distributions in concrete gravity dams. Part 2: behaviour 1018

**Ian Smith and Gerret Springer** Consideration of Gustafsson's proposed Eurocode 5 failure criterion for notched timber beams 1030

**Randall C. Brooks and William J. Daniels** Surveying instrument makers of Central Canada 1037

**Yohanna M.F. Wahba, Murty K.S. Madugula, and Gerard R. Monforton** Combined wind and ice loading on antenna towers 1047

**Norbert E. Yankielun, Michael G. Ferrick, and Patricia B. Weyrick** Development of an airborne millimeter-wave FM-CW radar for mapping river ice 1057

**K.S. McKay and M.A. Erki** Grouted anchorages for aramid fibre reinforced plastic prestressing tendons 1065

DISCUSSIONS

**B.R. Ravishankar, J.-F. Blais, and R.D. Tyagi** Coliform inactivation in sludge by copper sulphate: Discussion 1070

**D. Prasad, J.G. Henry, and A. King** Coliform inactivation in sludge by copper sulphate: Reply **1072**

**Joseph H.W. Lee** An experimental study of jet dilution in crossflows: Discussion **1073**

**John E. Hodgson and N. Rajaratnam** An experimental study of jet dilution in crossflows: Reply **1076**

**F.E. Hicks** Modeling spills on grass and impermeable surfaces: Discussion **1077**

**Edward A. McBean, Randy Belore, and Joseph Capka** Modeling spills on grass and impermeable surfaces: Reply **1078**

BOOK REVIEWS / CRITIQUES DE LIVRES

**N.J. Gardner** Concrete buildings — analysis for safe construction **1080**

**André Filiatrault** Analyse des structures **1081**

**Note of appreciation / Note de reconnaissance** **i**

**Author index for Volume 20 / Index des auteurs pour le volume 20** **AI-1**

**Contents for Volume 20 / Sommaire pour le volume 20** **C-1**